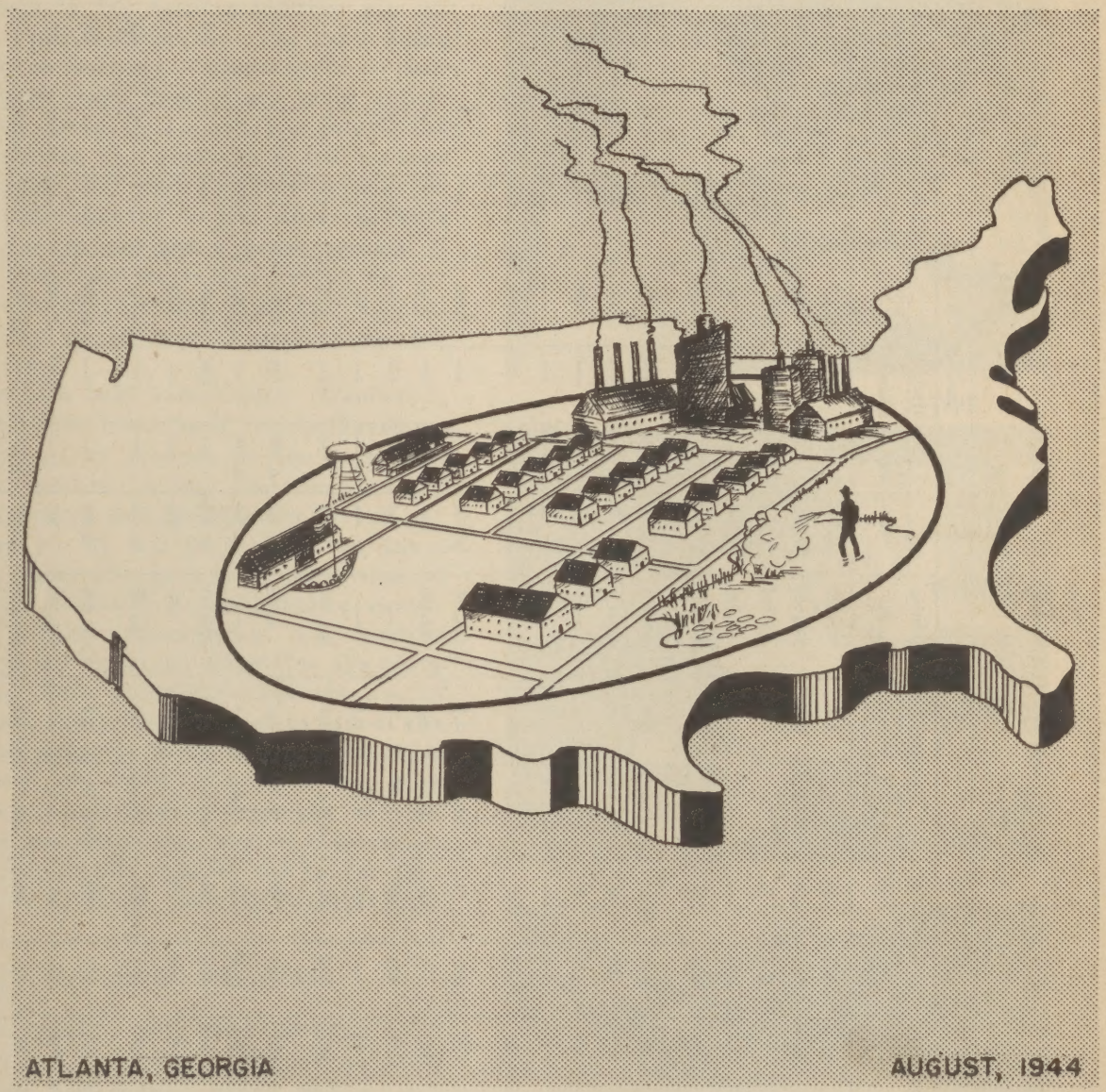
FIELD BULLETIN

IN-SERVICE TRAINING AND INFORMATION

MALARIA CONTROL IN WAR AREAS



ATLANTA, GEORGIA AUGUST, 1944

DREDGING AT MACON, GEORGIA

PRECIPITIN TESTS OF ANOPHELINE BLOOD MEALS

FEDERAL SECURITY AGENCY U. S. PUBLIC HEALTH SERVICE

TABLE I

MCWA LARVICIDE, MINOR & MAJOR DRAINAGE WORK

JULY 1 - 31, 1944

STATE	Areas in Operation	War Establishments Protected	LARVICIDAL WORK				DRAINAGE OPERATIONS											Total Man Hours
			Larvicide Used		Surfaces Treated Acres		Clearing		Cleaning	New Ditching				Ditch Lining Placed		Underground Drainage	Fill	Water Surf. Eliminated	
			Oil Gals.	Paris Green Lbs.	Oiled	Dusted	Removal Surf.Veg. Acres	Stumping Grubbing Acres	Sq.Ft.	Hand	Lin.Ft. Mach.	Dynamite	Total Cu.Yds.	Lin.Ft.	Sq.Ft.	Lin.Ft.	Cu.Yds.	Acres	
Alabama	8	74	1,787	175	108	86	7.2	1.8	725,450	8,545	---	---	1,097	---	---	---	2	7.0	9,042
Arkansas	15	72	21,380	443	1,652	412	100.5	0.3	392,627	11,469	850	300	2,662	---	---	23	---	---	35,015
California	4	29	5,915	79	537	24	3.4	2.3	65,296	3,308	---	---	104	---	---	---	---	5.7	5,072
D.C.	1	25	---	---	---	---	1.6	---	22,615	---	---	---	---	---	---	---	---	---	1,378
Florida	17	141	4,153	180	229	177	42.8	11.2	1,192,562	47,469	1,250	1,000	10,179	---	---	---	7,466	10.2	37,439
Georgia	14	101	317	3,195	13	2,551	36.9	0.2	121,873	6,454	975	---	953	162	405	---	934	0.6	26,459
Illinois	2	56	3,535	306	160	299	---	---	---	---	---	---	---	---	---	---	---	---	4,528
Indiana	2	44	1,807*	127	528*	80	---	---	---	380	---	---	130	---	---	---	---	30.0	3,405
Kansas	1	48	40	---	2	---	0.7	---	---	---	---	---	---	---	---	---	---	---	240
Kentucky	5	45	1,341	57	71	49	7.7	---	39,610	---	---	---	---	---	---	---	1	0.1	7,160
Louisiana	8	68	76,772	77	4,331	71	81.2	2.3	1,013,185	42,582	---	---	1,624	---	---	---	1,138	21.9	2,865
Maryland	1	34	20	335	1	301	0.5	---	22,139	---	---	---	---	---	---	---	---	---	3,194
Massachusetts	--	--	1,371	165	129	162	0.2	---	---	---	---	---	---	---	---	---	---	---	2,404
Michigan	2	2	---	44	---	50	1.9	0.8	---	---	---	---	---	---	---	---	12	---	752
Mississippi	16	60	11,899	609	449	247	172.4	0.2	601,010	1,875	---	---	75	---	---	---	---	---	25,306
Missouri	7	34	6,061*	1,747	941*	892	8.2	---	1,795	4,704	6,436	25	6,752	---	---	---	---	---	11,470
New York	--	--	580*	62	4*	41	3.0	---	---	1,780	4,770	---	2,740	---	---	---	---	2.0	7,099
North Carolina	10	72	3,449	241*	204	28*	196.6	0.6	995,411	13,736	---	450	1,605	---	---	120	283	2.5	38,822
Oklahoma	9	38	15,937	483	1,068	418	5.7	2.2	450	820	---	---	45	---	---	---	---	1.0	16,586
Puerto Rico	6	19	4,266	6,152	137	2,543	11.4	6.1	704,005	10,214	---	---	4,323	---	---	---	711	4.2	60,562
South Carolina	20	111	12,562	214	814	189	322.4	0.8	1,643,885	16,065	---	---	2,579	---	---	375	1,259	6.6	58,960
Tennessee	6	69	10,628	656	524	160	3.4	---	76,400	103	---	---	84	881	2,562	179	219	---	14,496
Texas	13	165	10,745	297	606	288	162.8	3.9	588,239	11,433	5,500	---	13,523	1,156	3,218	---	361	189.1	46,670
Utah	--	--	5	28	1	28	---	---	---	440	---	---	---	---	---	---	---	3.0	731
Virginia	4	99	5,547	7,383	125	1,488	57.6	0.9	---	29,950	---	---	3,899	903	2,709	---	---	---	31,962
Total	171	1,406	200,117*	23,055*	12,634*	10,584*	1,228.1	33.6	8,206,552	211,327	19,781	1,775	52,384	3,102	8,894	697	12,386	283.9	521,617
June Total	161	1,388	232,361	21,208	12,219	11,086	974.1	14.2	6,684,093	229,065	13,437	26,122	68,577	3,465	8,570	3,229	12,833	688.9	501,056

*Tentative figures - subject to revision

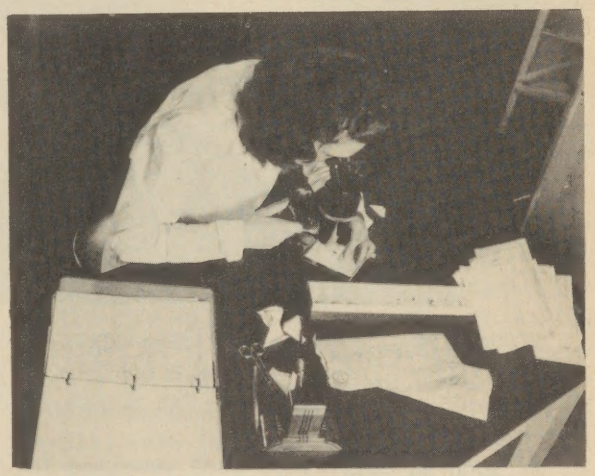
PRECIPITIN TESTS
of anopheline blood meals

The effectiveness of a given species of *Anopheles* as a malaria vector is influenced largely by its feeding habits, the important vectors throughout the world being those which feed most consistently on man. It has been found that in any given locality, there usually is but one *Anopheles* species which is responsible for malaria transmission and that by concentrating on this single species in any area, malaria can be controlled and a great amount of money, labor, and materials can be saved. This procedure is commonly called "species sanitation" or "*Anopheles* species control of malaria."

Anopheles quadrimaculatus, *freeborni*, and *albimanus* have been incriminated on epidemiological grounds as the important malaria vectors in the southeastern and western States and Rio Grande Valley respectively. To add more light to these general observations and to determine if there are seasonal or geographic variations in host preferences, the feeding habits of our American *Anopheles* are being studied. This study involves the use of the precipitin test to determine the source of mosquito blood meals. Inspectors throughout the areas covered by the MCWA program are collecting engorged anophelines in the course of routine inspections and are forwarding them to the Carter Laboratory at Savannah, Georgia for testing.

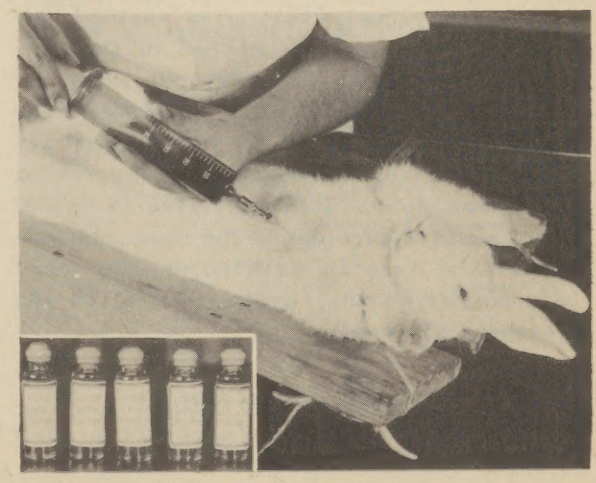
COLLECTION OF SPECIMENS

Only freshly engorged females with swollen red abdomens, indicating that they have had recent blood meals, are suitable for testing. Specimens are collected early in the morning so that the amount of digestive action on the blood will be minimized. Specimens are being collected from a wide variety of resting places, and it is planned to obtain as many as 1,000 specimens of each available species from each locality throughout the season.

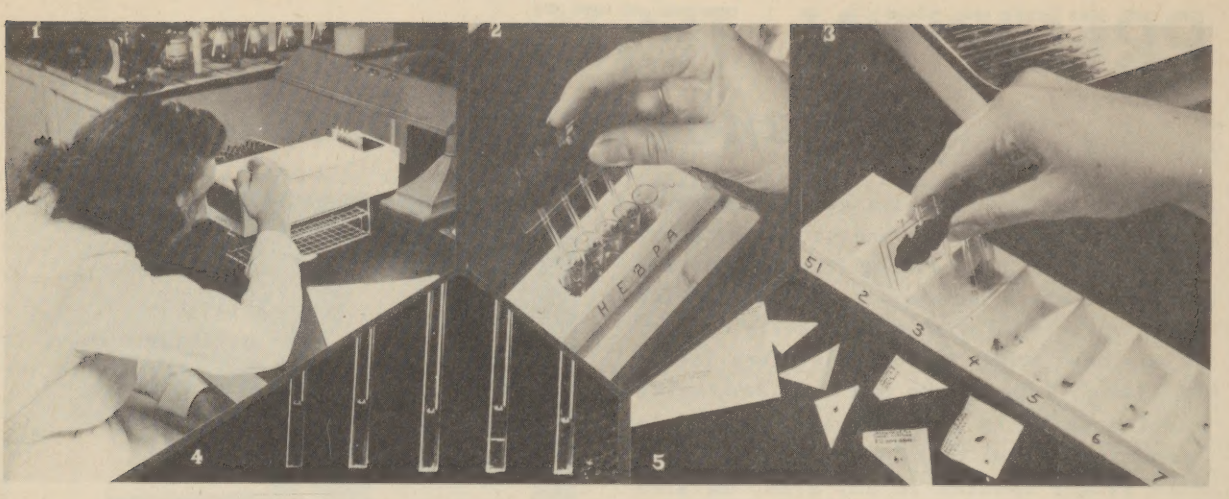


CHECKING SPECIES IDENTIFICATION

INOCULATING RABBIT WITH STERILE SERUM



BLEEDING RABBIT TO OBTAIN ANTISERUM



EXAMINING (1) CAPILLARY TUBES CONTAINING HUMAN, EQUINE, BOVINE, PORCINE AND AVIAN ANTISERA (2) AND UNKNOWN BLOOD SERUM (3). A PRECIPITATE IN ONE OF THE TUBES (4) INDICATES THE SOURCE OF THE MOSQUITO BLOOD MEAL (5).

As soon as collected, each specimen for testing is crushed on an individual small square of filter paper which is folded to form a triangular envelope. The whole mosquito is left in the "triangle" so that a check on the identification of the species can be made. The following data are supplied for each collection and are written with a soft pencil on the side of the paper on which the specimen is crushed: (a) general locality (State and nearest town); (b) specific place collected (e.g. bedroom, barn, chicken coop, privy, etc.); (c) species of mosquito; (d) distance from nearest available continual source of *human* blood (if such is screened, "S" is added after the distance; if unscreened, "O" is added); (e) name of collector; (f) date. Individual "triangles" are placed in an envelope and are mailed to the Carter Laboratory on the day they are collected. Large numbers of specimens from a single resting place are not labeled individually, but each separate species or collection from a different area is mailed in a separate envelope. The name and number of the area is written on the upper left corner of the envelope in which the specimens are mailed.

THE PRECIPITIN TEST

The Uhlenhuth-Weidanz precipitin test is based upon the fact that a visible precipitate forms at the interface between blood serum and its antiserum. Rice and Barber* modified the technique of precipitin testing to facilitate examination of thousands of mosquito blood meals. By their method a portion of the small amount of blood of unknown source from the stomach of a single mosquito is brought into contact with antisera prepared from several known hosts. If a precipitate is formed in one of the tubes the source of the blood meal is revealed.

PREPARATION OF ANTI-SERA

Anti-sera are prepared by injecting sterile human, equine, bovine, porcine, and avian blood sera into rabbits. The rabbits are given six intravenous injections of sera totaling 4 cc. over a period of 12 days. The titer, or strength of the anti-bodies that develop in the rabbit's blood, is tested by determining the greatest dilution of antiserum that produces a precipitate upon contact with the corresponding blood serum. To obtain antisera, rabbits are bled from the heart, taking from 40 to 60 cc. of blood. The blood is centrifuged and the resulting serum is then diluted one to seven with

*Rice, J. B. and M. A. Barber. Malaria Studies in Greece. A Modification of the Uhlenhuth-Weidanz precipitin test for determining the sources of blood meals in mosquitoes and other insects. J. Lab. and Clin. Med., 20: 876-883, 1935.

the following solution: sodium chloride 4.25 grams; glycerine 106.0 cc.; phenol (liquefied) 2.5 cc.; and distilled water 330 cc. The phenol serves as a preservative and the glycerine increases the specific gravity of the diluent.

PREPARATION AND TESTING OF BLOOD SAMPLES

Specimens mailed in from the field are held in the refrigerator until they are examined. Before testing the blood samples, the mosquito identification is checked, the data accompanying the specimen are recorded, and the blood spot is cut out of the piece of filter paper and placed in a compartment of a tray. The blood is soaked off the filter paper with physiologic salt solution (3 cc.) and then is allowed to settle to insure a clear supernatant fluid for the test. This liquid is picked up by capillarity in five glass tubes cemented into a unit between two glass slides. The tubes have an inside diameter of approximately 1.5 mm. and the liquid rises in them to a distance of about one and a half centimeters. Half of the fluid is then withdrawn by touching the tips of the tubes to a pad of filter paper. The unit of tubes is then touched to the surfaces of the five antisera that were prepared previously, thus replacing with antisera the halves of the original blood sera that were withdrawn on the filter paper. Finally the unit is placed in a rack at room temperature to allow time for the precipitin reaction to take place. After thirty minutes the tubes are suspended behind a magnifying glass in an illuminated reading box. The source of the mosquito blood meal is indicated by a white ring formed at the interface between the two liquids in the appropriate tube.

RESULTS

Precipitin tests must be interpreted with caution. A mosquito may have interrupted its meal and fed on another host, it may have fed on a host not included in the tests, or on a host closely related to one included in the tests (mule instead of horse). The blood may have been too thoroughly digested in the mosquito or too completely decomposed during mailing.

Results for the year are tabulated according to species and according to States. Twenty States submitted a total of nearly 30,000 specimens. Of these, approximately 50% were unsatisfactory because the samples were improperly prepared.

Table I presents a general summary of the results of precipitin tests made to June 30, 1944. The number of tests for each species of mosquito is shown, together with the number and percent of feedings on the different hosts. Because of the relatively small number of tests, no general conclusions are warranted at this time. However, it is clear that over half of all the *Anopheles* mosquitoes tested fed on bovine hosts and *albimanus* showed the highest percentage of human blood meals.

Table II shows the data according to States. Although not presented here, a partial analysis of seasonal data suggests that a higher percentage of *quadrimaculatus* specimens feed on man in the spring than in the fall while the reverse is true of the other anophelines tested.

TABLE I. Results of precipitin tests showing number and percent of tested specimens of six species of *Anopheles* feeding on specified hosts - to June 30, 1944.

Species	Human		Equine		Bovine		Porcine		Avian		No reaction		Total No.
	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent	Tested
quadrimaculatus	366	4.2	1479	16.9	4646	53.0	1041	11.9	228	2.6	997	11.4	8757
punctipennis	39	3.0	240	18.4	756	57.8	154	11.7	25	1.9	94	7.2	1308
mac. freeborni	27	4.4	70	11.3	384	62.1	25	4.1	5	.8	107	17.3	618
crucians	61	3.9	146	9.4	870	56.1	194	12.5	88	5.7	191	12.4	1550
pseudopunctipennis	21	3.8	33	6.0	401	73.0	25	4.6	12	2.2	57	10.4	549
albimanus	30	8.4	19	5.3	243	68.1	15	4.2	8	2.2	42	11.8	357

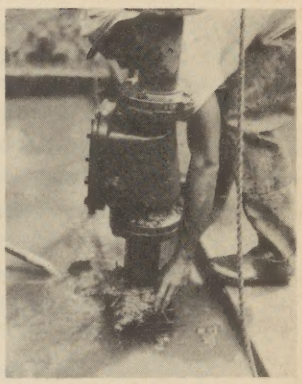
TABLE 11. Tabulation of anopheline blood meals by species and states giving number and percent of tested specimens feeding on specified hosts.

States	Species	Human		Equine		Bovine		Porcine		Avian		No Reaction		Total
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	Tested
Alabama	*quadrimaculatus*	23	11.9	10	5.2	124	64.3	5	2.6	3	1.5	28	14.5	193
	punctipennis	0	-	3	11.5	18	69.2	1	3.8	0	-	4	15.4	26
	crucians	1	2.2	0	-	43	93.5	0	-	0	-	2	4.3	46
Arkansas	*quadrimaculatus*	104	14.1	95	12.9	369	50.1	84	11.4	14	1.9	71	9.6	737
	punctipennis	4	13.8	3	10.3	14	48.3	2	6.9	1	3.5	5	17.2	29
California	*mac. freeborni*	27	4.4	70	11.3	384	62.1	25	4.1	5	.8	107	17.3	618
Florida	*quadrimaculatus*	14	6.9	14	6.9	129	63.6	12	5.9	10	4.9	24	11.8	203
	crucians	9	8.6	10	9.5	54	51.4	10	9.5	9	8.6	13	12.4	105
Georgia	*quadrimaculatus*	14	5.6	30	12.0	119	47.6	36	14.4	4	1.6	47	18.8	250
	punctipennis	1	1.9	4	7.9	28	54.9	13	25.5	1	1.9	4	7.9	51
	crucians	12	5.3	21	9.3	119	53.3	41	18.3	12	5.3	19	8.5	224
Illinois	*quadrimaculatus*	3	1.8	27	16.1	76	45.2	45	26.8	5	3.0	12	7.1	168
	punctipennis	3	1.5	34	17.0	98	49.0	42	21.0	9	4.5	14	7.0	200
Indiana	*quadrimaculatus*	0	-	2	7.1	15	53.6	1	3.6	1	3.6	9	32.1	28
	punctipennis	0	-	0	-	2	7.1	25	89.3	1	3.6	0	-	28
Iowa	*punctipennis*	0	-	4	16.7	15	62.5	0	-	0	-	5	20.8	24
Kansas	*quadrimaculatus*	0	-	0	-	10	52.6	6	31.6	0	-	3	15.8	19
Kentucky	*quadrimaculatus*	0	-	9	23.7	11	28.9	16	42.1	0	-	2	5.3	38
	punctipennis	1	1.0	33	33.0	48	48.0	11	11.0	2	2.0	5	5.0	100
Louisiana	*quadrimaculatus*	81	3.1	285	10.9	1602	61.0	295	11.2	84	3.2	278	10.6	2625
	punctipennis	3	6.7	8	17.8	25	5.5	3	6.7	2	4.4	4	8.9	45
	crucians	16	2.8	18	3.2	316	55.5	72	12.6	52	9.1	95	16.7	569
Maryland	*quadrimaculatus*	11	9.5	5	4.3	28	24.1	56	48.3	2	1.7	14	12.1	116
Mississippi	*quadrimaculatus*	3	.8	67	18.2	213	57.9	39	10.6	8	2.1	38	10.3	368
	punctipennis	1	1.3	16	21.1	48	63.2	1	1.3	1	1.3	9	11.8	76
	crucians	6	4.6	20	15.4	82	63.1	14	10.8	0	-	8	6.1	130
Missouri	*quadrimaculatus*	9	6.5	13	9.4	32	23.2	56	40.6	8	5.8	20	14.5	138
	punctipennis	2	7.7	4	15.4	11	42.3	7	26.9	0	-	2	7.7	26
N. Carolina	*quadrimaculatus*	0	-	7	17.1	24	58.5	7	17.1	1	2.4	2	4.9	41
	punctipennis	0	-	2	13.3	10	66.7	3	20.0	0	-	0	-	15
Oklahoma	*quadrimaculatus*	1	2.5	7	17.5	15	37.5	9	22.5	3	7.5	5	12.5	40
	punctipennis	0	-	18	16.5	59	54.2	13	11.9	1	.9	18	16.5	109
Oregon	*punctipennis*	0	-	0	-	19	76.0	2	8.0	0	-	4	16.0	25
S. Carolina	*quadrimaculatus*	3	2.9	10	9.6	65	62.5	19	18.3	2	1.9	5	4.8	25
	punctipennis	9	6.3	17	11.9	99	69.2	4	2.8	1	.7	13	9.1	143
Tennessee	*quadrimaculatus*	12	1.3	239	26.1	455	49.7	138	15.0	6	.7	66	7.2	916
	punctipennis	3	1.7	53	30.8	93	54.1	10	5.8	0	-	13	7.6	172
Texas	*quadrimaculatus*	71	4.1	407	23.5	951	55.0	110	6.4	33	1.9	150	9.1	1730
	punctipennis	11	4.6	38	15.7	156	64.5	17	7.0	5	2.0	15	6.2	242
	crucians	11	3.5	52	16.5	173	54.9	40	12.7	5	1.6	34	10.8	315
	pseudopunctipennis	19	3.5	30	5.6	396	73.7	25	4.7	11	2.1	56	10.4	537
	albimanus	30	8.4	19	5.3	243	68.1	15	4.2	8	2.2	42	11.8	357
Virginia	*quadrimaculatus*	17	1.7	245	24.4	395	39.4	101	10.1	42	4.2	203	20.2	1003
	punctipennis	0	-	3	23.1	10	76.9	0	-	0	-	0	-	13
	crucians	0	-	11	13.4	45	54.8	4	4.9	11	13.4	11	13.4	82
												TOTAL		12,945

DREDGING *at Macon, Georgia*

DISCHARGING
DREDGED MATERIAL

HYDRAULIC DREDGE



CLEANING TRASH
FROM INTAKE

The reconstruction of Stratton Canal located in the Fuse Plant Zone at Macon, Georgia, has been a very interesting and somewhat difficult problem.

The lower 5500' of the canal traverses a swamp where topography seldom varies over two to four feet, and in which *"quad"* breeding has at times been quite prolific. The canal was blocked or partly filled with mud, silt, roots, leaves, and other debris. This material was of very loose composition but would not erode because of the sluggishness of the stream.

A four inch dredge was planned, constructed, and put in operation on Stratton Canal. The main elements of the dredge are a four-inch sand pump and a 25 HP diesel motor connected by a V-belt. It is mounted on a barge 8' x 16' with a 4' x 8' pumping well on the forward end. Flotation is obtained by eighteen 55-gallon oil drums beneath the barge and two similar drums mounted under the catwalk. The suction head and hose are controlled by the use of an 11' boom on an A frame, both of which are made of 3 inch pipe, with the lifting line powered by a 2 ton hand operated winch. Auxiliary equipment includes: 50' of 4" flexible suction and discharge hose, a 4" flap valve, 1½" pump for priming and jetting purposes, a home-made lighting plant powered by a washing machine motor, and the necessary valves and pipe fittings, including an 8" x 8" x 4" strainer with openings approximately 2" x 2".

The dredge cost approximately $1000.00 and should have a useful life of several years. Fuel requirements for operations are: 1¼ to 1½ gallons per hour of diesel fuel, 2 gallons gasoline per day for starting the diesel motor and operating the small pump and light plant and about 1 pint of lubricating oil per hour for the diesel motor.

During a recent period, 417 cu. yds. of material were dredged, using 687 man hours and 179 machine hours. Undoubtedly this is costly excavation, but it does represent the entire cost since little clearing and no grubbing operations are necessary. Where comparatively little or no trash is encountered, this yardage cost can be reduced by at least 60 to 80%.

It is anticipated that the entire cost of dredging will be more than equalled by the saving in larviciding costs on the basis of two years operations. The dredging machinery constructed for this project can be used on other major drainageways throughout the State. — William A. Legwen

HEADQUARTERS NOTES

Organization

MCWA Headquarters was originally organized into sections for purposes of administration. With the increase in activities the Training and Education Section has been designated as the Training Division and the Entomology, Engineering, and *Aedes aegypti* Sections of the Division of Operations have been raised to the status of Divisions. The three divisions engaged in control operations are coordinated by a Director of Operations. A chart appears on the back cover showing the present organization.

Visitors

Surgeon General Thomas Parran inspected Public Health Service installations and activities in Charleston, Columbia, Savannah, and Atlanta from August 15 to 19. Accompanying Dr. Parran were Medical Director Paul Stewart, Chief Inspection Officer, office of the Surgeon General; Medical Director Joseph Mountin, in charge of the Division of States Relations, Surgeon William Stimson, executive officer for the Chief of the Coast Guard Medical Service; Medical Director C. R. Eskey, in charge of Typhus Control; and Medical Director Joseph Bolton, Liaison Officer for the 4th Service Command.

Dr. A. L. Ayroza Galvao, parasitologist at the Medical School of the University of Sao Paulo, visited Headquarters and field projects to familiarize himself with the MCWA program.

P. A. Engineer (R) W. E. Gilbertson made a brief visit to the mainland to report on the year's results in the Hawaiian Dengue Control Program.

Sanitation Conference

A conference of sanitary officers of the 4th Service Command was held July 17-20 at Ft. McPherson, Ga. There were nearly 100 officers in attendance. San. Engr. (R) H. G. Hanson spoke on the interrelations of MCWA and the Army malaria control programs. MCWA personnel profited greatly from the individual and group discussions on mutual malaria control problems.

Commissioned Officers

The following men have recently been commissioned: Asst. Engineers (R) Samuel Schneider, Lee D. Dumm, J. P. Welsh, Marshall Rainey, R. L. Stenburg, Jr.; Asst. San. Engr. (R) Leonard Melberg; Jr. Asst. Engr. (R) E. R. Smith; Jr. Asst. San. (R) G. M. Williams; and Asst. San. (R) William Upholt.

Four regular corps officers were assigned to various MCWA activities. Sr. Surgeon A. G. Gilliam heads the Medical Division. His previous assignment was with the War Department on duty with the Typhus Commission. Dr. Gilliam served in the Middle East and in the China, Burma, India Theater of Operations. Surgeon V. B. Link has been assigned to the Medical Division after a tour of foreign duty. P. A. San. Engr. J. G. Terrill has been assigned to the Division of Engineering.

Changes in headquarters assignments included San. (R) Eli Abbott, Jr., who went to New Orleans as MCWA District Engineer, P. A. San. Engr. (R) H. L. Grant, who transferred from New Orleans to Atlanta where he is Executive Officer of the Engineering Division, and Asst. San Engr. (R) Russell G. Ludwig, transferred from Elba, Ala., to Atlanta, where he will handle engineering data in the Records and Statistics Section in addition to other duties in the Engineering Division.

Changes in personnel in Puerto Rico include P. A. Engr. (R) C. G. Humphreys who returns after three years in the islands, and P. A. San. (R) A. E. Pritchard, who returns from Jamaica, to be replaced by Asst. San. (R) G. A Thompson, Jr., formerly in charge of the area at Valdosta, Ga.

The United Nations Relief and Rehabilitation Administration has already acquired some MCWA officers. Two additional officers, P. A. Surgeon (R) Herbert R. Abrams, of the Medical Division, and P. A. San. Engr. (R) Paul C. Henderson, State MCWA Engineer for Florida, have now received orders to report to UNRRA.

SECTION NOTES

Western *Anopheles* in Brackish Water

Asst San. (R) W. W. Farrar reports that *Anopheles maculipennis freeborni* Aitken and *Anopheles pseudopunctipennis franciscanus* McCracken, normally fresh water mosquitoes, were found breeding in brackish water at the lower end of Sorrento Valley, 15 miles north of San Diego, California in a marsh known as Sorrento Wash. This marsh extends inland from the ocean and is heavily overgrown with Salicornia for a distance of 1½ to 2 miles inland.

Analyses of water samples taken from the Wash were made by the U. S. Department of Agriculture Salinity Laboratory at Riverside, and it was found that waters from which *franciscanus* larvae were collected contained chlorides equivalent to 34 percent sea water, while those from points where *freeborni* larvae were collected contained chlorides equivalent to 15 percent sea water. *Franciscanus* larvae were more abundant than those of *freeborni*. *Culex tarsalis* was the only culicine found breeding with these anophelines.

Captain MacMillan, Post Sanitary Officer at Camp Callan, has found *freeborni* and *franciscanus* larvae in saline concentrations equivalent to 16 and 32 percent sea water, respectively, and Ensign W. W. Grafton, Entomologist at the San Diego Navy Hospital has found *franciscanus* in saline concentrations equivalent to 60 percent sea water.

Distribution of *freeborni* and *occidentalis* in Colorado

New information on the distribution of western Anophelines has been reported by Asst. San. (R) Edward Perry. *Occidentalis* was collected in the following new localities: Great Falls and Livingston, Montana; Glenrock and Douglas, Wyoming; and Denver, Colorado, It appears, therefore, that *occidentalis* extends from its known distribution in the northern tier of States southward along the east slope of the Rockies as far as Denver. Attempts to collect *Anopheles* north of Glenrock and Douglas were fruitless, and attempts to get any south of Denver were likewise unsuccessful. *Freeborni* was found on the western slope of the Rockies in Colorado at Eagle, Silt, and Grand Junction. Mr. Perry concludes that *occidentalis* is distributed throughout the north and extends down the east side of the continental divide throughout the eastern half of Wyoming and eastern Colorado at least as far as Denver and probably farther. *Freeborni* apparently is found only on the western slope of the continental divide and extends through western Wyoming, nearly all of Idaho and Utah, and westward to the coast.

Aedes aegypti

The *Aedes aegypti* Division has compiled data evaluating the potential dengue-yellow fever problem in the vicinity of major ports and airports of entry, Army and Navy general hospitals, and key industrial cities.

Puerto Rico

The first use of powerful Chemical Warfare Service decontamination sprayers as larviciding equipment has been reported from Puerto Rico. At Losey Field, MCWA and the Army are sharing three spray units, and excellent results have been obtained. High pressure homogenizes the oil to such an extent that only a light film application is necessary to secure maximum control.

Puerto Rico has suffered from abnormal rainfall during the past month. When a hurricane passed near the island, twelve inches of rain fell overnight. This unusual weather has affected MCWA operations all over this territory, and its influence will doubtless be felt for some time to come.

In-Service Training

Five officers and one Civil Service employee completed their training during July. Three other newly commissioned officers studied general aspects of the course before leaving for special assignments.

Three officers detailed for foreign duty with UNRRA completed the condensed technical training course of one week

LITERATURE REVIEW

The Journal of the National Malaria Society, Volume III, Number 2, June 1944.

The current number of the Journal of the National Malaria Society includes minutes of the 1943 meeting, and an "official call" to attend the twenty-seventh annual meeting to be held in St. Louis, Mo. November 14, 15, and 16, 1944. The following papers are included:

Faust, E. C. Malaria Mortality and Morbidity in the United States for the year 1942.

Dr. Faust gives another of his valuable yearly assays of malaria mortality and morbidity trends. The situation for 1942 is summarized as follows: "The malaria mortality data show a continued improvement over previous years. Only eight states had a rate of 1.0 or more per 100,000 and only four counties had a rate of 25.0 or more. "The malaria morbidity data continue to be unreliable when tested against the expected ratios of deaths to cases. In mildly endemic territory, such as the malarious areas of the United States have become, it is estimated that there were between 236,000 and 590,000 cases in 1942 as compared with 278,000 to 695,000 in 1941."

Clark, H. C. *Recent Research in Prophylaxis and Treatment of Malaria.*

Twenty publications are reviewed and the author adds notes from his personal experience in Panama. "The concensus of opinion indicates that quinine is still the drug of choice if available, atabrine next and totaquine (U.S.P.) for the less important services."

Hewitt, R. I. *Recent Research in Avian and Simian Malaria.*

Literature on avian and simian malaria is reviewed from the earlier reports to the National Malaria Society (1941) up to October 1, 1943. Seventy-six papers on avian malaria and eleven on simian malaria are cited. *Plasmodium juxtanucleare* Versiani and Gomes (1941) is a new species recently described from domestic fowls in Brazil and *Plasmodium durae* Herman (1941) is a newly described avian malaria parasite of turkeys in Africa. Reviews are given on pathology, chemotherapy, and immunity of both avian and simian malaria.

Underwood, F. J. *Malaria Prevention Activities of State Boards of Health, 1943*

State malaria control activities are analyzed and it is concluded that "State Boards of Health should begin planning now to secure special funds from State, local, and national official agencies for prevention of malaria on a perpetual basis."

Sawyer, W. A. *The Introduction of Tropical Diseases Other than Malaria into the United States after the War.*

Tropical diseases which might be introduced into the United States are discussed under the headings: insect-borne diseases; diseases conveyed by food and water; and diseases due to worms, other than filariasis. The statement is made that, "There are few tropical diseases not already in the United States which are likely to be introduced and become established in the postwar era."

Hackett, L. W. *Spleen Measurement in Malaria.*

Spleen surveys are discussed in relation to parasite surveys. Examination of some 40,000 individuals for enlarged spleens and malaria parasites in Italy and Albania disclosed that over 95 per cent of the endemic malaria present was revealed by the spleen survey alone. A simplified method of examining spleens and recording their sizes is described which has stood the test of time and of statisticians in many lands.

Bates, Marston. *Notes on the Construction and Use of Stable Traps for Mosquito Studies.*

An account is given of experiments with mosquito traps in Egypt and Colombia. The type of trap developed by Magoon proved to be unsatisfactory. Anophelines with outdoor resting habits are apparently able to escape from traps with a vertical opening rather readily; it was found that mosquitoes that could not be caught in numbers in stable traps with the ordinary vertical ingress slit could be trapped if this ingress slit were arranged in a horizontal plane so that the mosquitoes would have to fly downwards to escape.

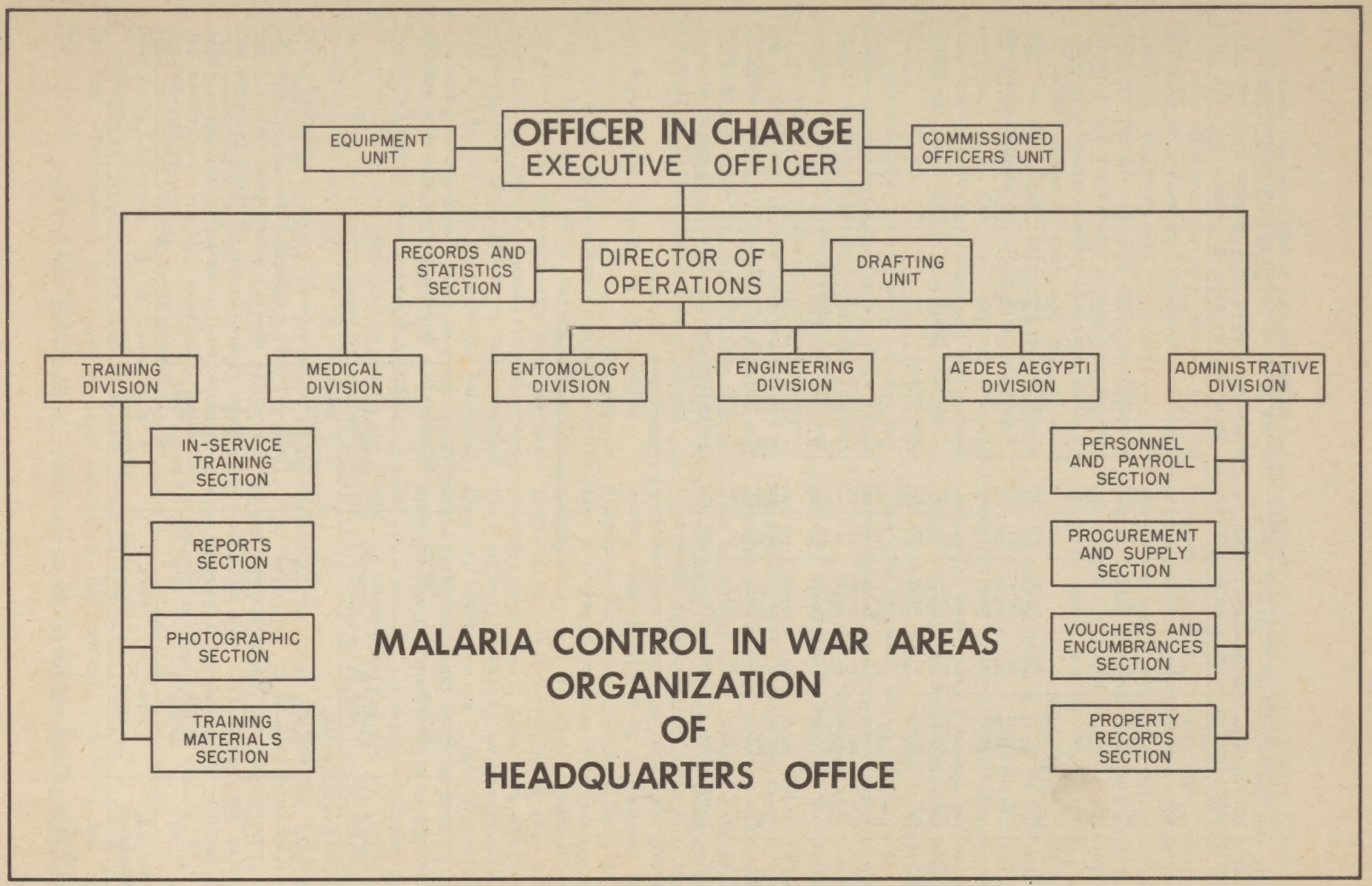
TABLE II. MCWA EXPENDITURES AND LIQUIDATIONS BY MAJOR ITEMS, JULY 1944

	Continental U. S.	Percentage of Total	Puerto Rico	Percentage of Total
.01 Personal Services	$464,880.26	86.94	21,693.44	96.79
.02 Travel	23,455.30	4.39	115.75	.52
.03 Transportation of Things	3,750.00	.70	200.00	.89
.04 Communication Services	1,383.00	.26	25.00	.11
.05 Rents and Utilities	2,355.01	.44	------	-----
.06 Printing and Binding	------	-----	------	-----
.07 Other Contractual Services	1,773.87	.33	------	-----
.08 Supplies and Materials	27,710.78	5.18	341.24	1.52
.09 Equipment	9,422.96	1.76	37.75	.17
Total	$534,731.18	100.00	22,413.18	100.00
Expenses other than Personal Services	$ 69,850.92	13.06	719.74	3.21

TABLE III. MCWA PERSONNEL ON DUTY AND TOTAL PAYROLL, JULY 1944

State	Commissioned		Prof. & Sci.		Sub-Prof. (1)		C. A. F.		Custodial and Per Hour		Total		Percent of Total	
	No.	Pay	No.	Pay	No.	Pay	No.	Pay	No.	Pay	No.	Pay	No.	Pay
Alabama	5	1,389	1	264	2	548	2	425	32	4,495	42	7,121	1.23	1.46
Arkansas	8	2,432	6	1,732	32	6,119	4	750	165	18,958	215	29,991	6.06	6.14
California	3	657	--	--	7	1,365	3	618	21	3,720	34	6,360	.99	1.30
D. C.	1	333	--	--	4	781	1	380	4	608	10	2,102	.29	.43
Florida	7	2,132	7	1,972	19	3,672	5	933	197	25,486	235	34,195	6.89	7.02
Georgia	8	2,492	3	696	40	7,648	6	987	97	12,454	154	24,277	4.51	4.98
Illinois	6	1,782	1	203	3	468	1	76	18	2,195	29	4,724	.85	.97
Indiana	2	570	--	--	2	303	--	--	12	1,617	16	2,490	.46	.51
Kentucky	4	1,199	2	711	16	2,523	1	230	19	2,339	42	7,002	1.23	1.43
Louisiana	12	3,550	4	1,221	47	9,221	6	949	335	43,307	404	58,248	11.95	11.97
Maryland	2	533	--	--	6	862	2	438	15	1,572	25	3,405	.73	.70
Mississippi	6	1,759	3	801	12	2,666	4	566	104	13,570	129	19,362	3.78	3.97
Missouri	1	333	--	--	14	2,704	1	152	42	4,769	58	7,958	1.70	1.68
North Carolina	6	1,807	4	1,438	12	2,319	4	726	200	24,933	226	31,223	6.62	6.46
Oklahoma	5	1,500	1	264	12	2,384	1	223	66	7,432	85	11,803	2.49	2.47
Oregon	1	199	1	132	1	294	--	--	--	--	3	625	.09	.12
Puerto Rico	8	2,734	1	310	6	1,190	5	1,098	344	16,361	364	21,693	10.77	4.45
South Carolina	5	1,673	5	1,437	32	6,234	5	314	282	35,184	329	45,342	9.65	9.31
Tennessee	4	1,140	3	659	5	1,353	3	584	68	8,057	83	11,793	2.43	2.42
Texas	7	1,995	4	1,289	28	5,930	5	891	219	27,774	263	37,879	7.71	7.78
Virginia	3	853	2	696	25	4,695	3	592	158	20,470	191	27,306	5.60	5.61
AEDES AEGYPTI														
Alabama	--	--	--	--	8	1,155	1	107	--	--	9	1,262	.26	.26
Florida	--	--	--	--	38	6,306	2	214	--	--	40	6,520	1.27	1.34
Georgia	1	285	--	--	9	1,377	--	--	--	--	10	1,662	.29	.34
Louisiana	1	285	1	264	16	2,961	1	164	1	166	20	3,840	.58	.78
South Carolina	1	285	--	--	11	1,997	1	164	1	130	14	2,576	.46	.53
Texas	4	1,109	1	118	31	5,117	2	241	5	700	43	7,285	1.26	1.49
Hq. & Dist. (2)	80	26,358	17	4,068	50	9,059	117	20,602	20	2,969	284	63,046	8.33	12.96
Mobile Units	--	--	1	141	6	812	--	--	45	4,531	52	5,484	1.52	1.12
Total	191	59,384	68	18,406	494	92,063	186	32,924	2470	283,797	3409	486,574	100.00	100.00
Percent of Total	5.6	12.20	1.99	3.78	14.49	18.92	5.45	6.76	72.47	58.34	100.00	100.00		

(1) Includes Entomological Inspectors
(2) Includes Headquarters and District Offices, malaria survey, Imported malaria control, special investigations, and employees temporarily attached to Headquarters pending assignment to states.


OFFICER IN CHARGE
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COMMISSIONED OFFICERS UNIT
RECORDS AND STATISTICS SECTION
DIRECTOR OF OPERATIONS
DRAFTING UNIT
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MALARIA CONTROL IN WAR AREAS
ORGANIZATION
OF
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